This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(3 - 6i)(-2 + 8i)$$

The solution is $42 + 36i$, which is option C.

A. $a \in [-56, -49]$ and $b \in [12, 15]$

$-54 + 12i$, which corresponds to adding a minus sign in the first term.

B. $a \in [41, 46]$ and $b \in [-39, -34]$

$42 - 36i$, which corresponds to adding a minus sign in both terms.

C. $a \in [41, 46]$ and $b \in [33, 44]$

* $42 + 36i$, which is the correct option.

D. $a \in [-9, -5]$ and $b \in [-54, -45]$

$-6 - 48i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-56, -49]$ and $b \in [-13, -7]$

$-54 - 12i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 6^2 + 3 \div 15 * 2 \div 4$$

The solution is -23.900, which is option A.

A. $[-23.94, -23.85]$

* -23.900, this is the correct option

B. $[47.97, 48.03]$

48.025, which corresponds to two Order of Operations errors.

C. $[48.03, 48.14]$

48.100, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

D. $[-24.03, -23.94]$

-23.975, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-2244}{12}}i + \sqrt{165}i$$

The solution is Nonreal Complex, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Nonreal Complex

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{38025}{225}}$$

The solution is Whole, which is option C.

A. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

B. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

C. Whole

* This is the correct option!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 195.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$14 - 10^2 + 13 \div 20 * 8 \div 5$$

The solution is -84.960, which is option D.

A. $[-86.15, -85.68]$

-85.984, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[114.67, 115.06]$

115.040, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[113.95, 114.92]$

114.016, which corresponds to two Order of Operations errors.

D. $[-85.12, -83.54]$

* -84.960, this is the correct option

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{15876}{36}}$$

The solution is Whole, which is option C.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Whole

* This is the correct option!

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 126.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{54 + 55i}{-2 - 3i}$$

The solution is $-21.00 + 4.00i$, which is option B.

A. $a \in [-273.5, -271.5]$ and $b \in [3, 4.5]$

$-273.00 + 4.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-22, -20]$ and $b \in [3, 4.5]$

* $-21.00 + 4.00i$, which is the correct option.

C. $a \in [-22, -20]$ and $b \in [51, 52.5]$

$-21.00 + 52.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-27.5, -26]$ and $b \in [-18.5, -17]$

$-27.00 - 18.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [3.5, 6]$ and $b \in [-21.5, -20.5]$

$4.38 - 20.92i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 55i}{7 - 3i}$$

The solution is $5.84 + 10.36i$, which is option C.

A. $a \in [11, 12]$ and $b \in [2.5, 3.5]$

$11.53 + 2.91i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [338.5, 340.5]$ and $b \in [8.5, 12.5]$

$339.00 + 10.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [5.5, 6.5]$ and $b \in [8.5, 12.5]$

* $5.84 + 10.36i$, which is the correct option.

D. $a \in [5.5, 6.5]$ and $b \in [600, 603]$

$5.84 + 601.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [10, 10.5]$ and $b \in [-19.5, -17]$

$10.29 - 18.33i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 + 9i)(-5 + 6i)$$

The solution is $-44 - 57i$, which is option B.

A. $a \in [58, 66]$ and $b \in [-40, -32]$

$64 - 33i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-47, -43]$ and $b \in [-58, -56]$

* $-44 - 57i$, which is the correct option.

C. $a \in [10, 12]$ and $b \in [49, 55]$

$10 + 54i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [-47, -43]$ and $b \in [55, 60]$

$-44 + 57i$, which corresponds to adding a minus sign in both terms.

E. $a \in [58, 66]$ and $b \in [32, 37]$

$64 + 33i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-18}{2} + \sqrt{-36}i$$

The solution is Rational, which is option C.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

C. Rational

* This is the correct option!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
